

PRELIMINARY COMPARISON OF 3.5-CM AND 12.6-CM WAVELENGTH CONTINUOUS WAVE OBSERVATIONS OF MARS; H.J. Moore, U.S. Geological Survey, Menlo Park, CA, 94025 and T.C. O'Brien, R.F. Jurgens, M.A. Slade, T.W. Thompson, Calif. Inst. Tech., Jet Propulsion Laboratory, Pasadena, CA, 91109.

Radar observations of Mars at Goldstone in 1990 were conducted by transmitting pure sinusoidal signals at 3.5-cm wavelengths and receiving the Doppler-spread echoes from Mars at Earth. Radar transmissions were circularly polarized and the echoes recorded in two senses: depolarized (SC, same sense) and polarized (OC, opposite sense). Latitudes of the subradar points are between  $3.5^\circ$  and  $11.1^\circ$  S; longitude coverage is discontinuous (Fig. 1). A similar set of observations were conducted in 1986 at 12.6-cm wavelengths between latitudes  $3.1^\circ$  and  $13.9^\circ$  S [1,2].

Here, we compare and discuss the observed depolarized and polarized echo total cross-sections and their ratios for the two wavelengths. Depolarized echo total cross-sections at 3.5-cm wavelength are typically near or less than those at 12.6-cm except near  $300^\circ$  W where they are larger (Fig. 1A). Factors contributing to the variations and differences in cross-sections are unclear at this time. By analogy with the Moon, stronger echoes would be expected at the shorter wavelength, but this is not always the case for Mars. The relatively weaker 3.5-cm and stronger 12.6-cm echoes from  $135^\circ$  to  $181^\circ$  may be partly related to burial of diffuse scatterers by dust (particularly in the Tharsis-Elysium regions) and attenuation of the radar waves with depth; this attenuation is about 3 to 4 times greater at 3.5-cm than at 12.6-cm wavelength. On the other hand, concentrations of wavelength-size diffuse scatterers could be less for the shorter wavelength and greater for the longer one as is suggested by the rock frequency distribution at the Lander 2 site [3]. The strong echoes near  $300^\circ$  W are puzzling and may be related to observational uncertainties rather than Mars; large observational scatter is implied by the results between  $135^\circ$  and  $181^\circ$  W.

Polarized echo total cross-sections at 3.5-cm wavelength, like those at 12.6-cm, show large variations with longitude (Fig. 1B). The two sets of observations are more or less comparable between  $25^\circ$  and  $80^\circ$  W. Elsewhere, there are differences. Weak 3.5-cm echoes (near 0.055) near  $135^\circ$ - $181^\circ$  W and  $4.7^\circ$  S suggest very weak quasi-specular echoes (near 0.035) as one might expect for the dust covered region of Tharsis [4]; the large range of cross-sections at  $11^\circ$  S may be partly due to observational scatter, but the surface sampled is variable and includes different terrains than those near  $4.7^\circ$  S. The weak echoes near  $210^\circ$ - $235^\circ$  W are puzzling because they do not correlate with thermal inertias [5] or the 12.6-cm results. Similarly, the extremely strong echoes ( $>0.12$ ) between  $280^\circ$  and  $320^\circ$  W are much stronger than the 12.6-cm echoes, a result that is difficult to explain.

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Ratios of the 3.5-cm depolarized and polarized echoes (Fig. 1C) are similar to those at 12.6-cm except near 200°-232° W where they are much larger; these larger values are due to the weak depolarized echoes.

Analyses and modelling of 3.5-cm wavelength total cross-sections and echo spectra are in progress.

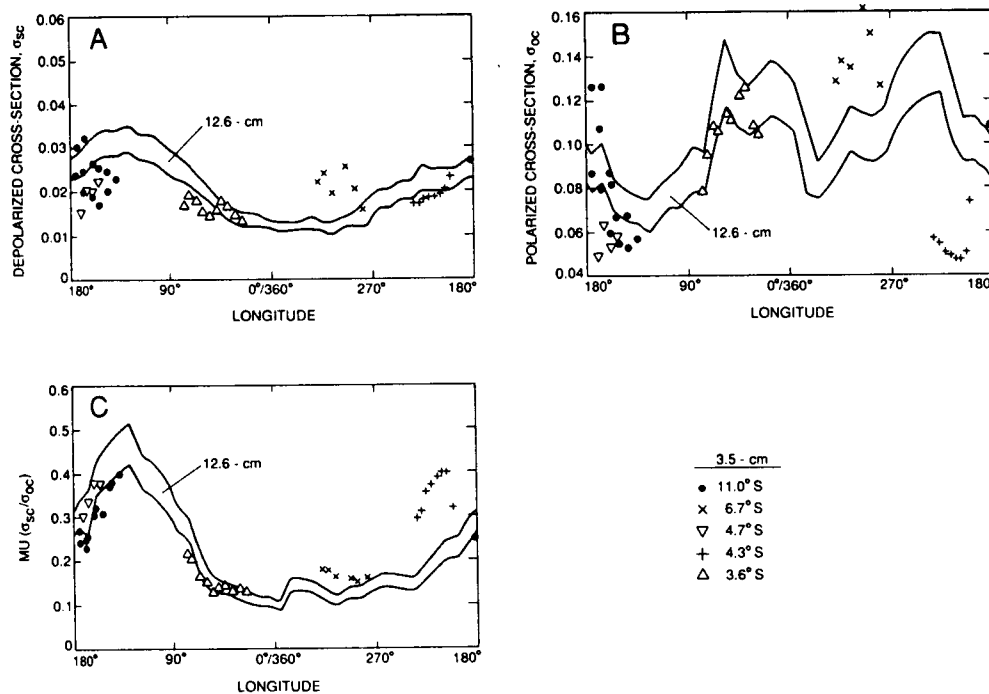


Figure 1. Comparison of Goldstone radar observations at 3.5-cm and 12.6-cm wavelengths as a function of longitude at latitudes between 3° and 14° S. A. Depolarized echo total cross-sections. B. Polarized echo total cross-sections. C. Ratio of depolarized and polarized echo total cross-sections.

## REFERENCES

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